WIN, LOSE, OR DRAW; CCIR AND THE COMMANDER'S ROLE IN BUILDING SHARED VISION

A MONOGRAPH
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ABSTRACT

Win, Lose, or Draw; CCIR and the Commander's Role in Building Shared Vision
by Major John R. Sutherland III

This monograph analyzes doctrine relating to the creation of Commander's Critical Information Requirements (CCIR) and its role in providing direction to units in combat. It compares doctrine to theory to assess it's doctrine's applicability in the face of rising complexity. It reviews the battles of LZ X-Ray and LZ Albany to assess US Army decision making on a complex battlefield and to compare it to theory and doctrine. The paper addresses a gap in doctrine; the lack of a CCIR derivation methodology. A methodology is required to aid the commander in building and communicating his vision to his unit. This paper offers a methodology and a series of recommendations to aid in its application.

History has revealed a tendency towards the evolution of more complex battlefields. This has generated a continuous challenge for command and control. Theory offers a description of the rising complexity. Ludwig Von Bertalanffy's General Systems Theory describes holistic problem solving. Michael Waldrop and John Casti describe the theory of complexity and offer practical applications for it's use. Peter Senge offers a series of mental disciplines designed to develop personal and organizational systems thinking and the field of information management offers techniques for systems analysis and design. The combination of these theories, disciplines, and professional fields offers a potential solution for simplifying control, managing information, and building common purpose within military units.

The CCIR methodology is a commander's tool. He uses it to provide guidance to his staff to focus the military decision making process and to discipline the flow of information to him. The methodology is holistic and non linear. It facilitates anticipation, self adaptation, and routing of "useful" information to the commander that directly relates to the decisions he must make.

The methodology requires the commander to; ascertain enemy and friendly task and purpose, develop concept sketches, plot disposition, analyze avenues of approach and mobility corridors, develop concepts for enemy and friendly courses of action, wargame the concepts to identify decision points, and determine the factors that define each potential decision. These factors include enemy actions, adjacent unit actions, subordinate unit actions, and protection of specific activities from enemy observation. This becomes commander's guidance. It is not absolute or exclusive of staff innovation, refinement, confirmation, or denial. Finally, the methodology offers new formats for the communication of CCIR to the unit to enhance the development of shared vision.

The human element must "stay in the loop" if operations are to be successful in complex environments. To rely on technology is to return to the World War I mentality of the Chateau Generals so despised by J.F.C. Fuller and most historical scholars.

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INTRODUCTION

"Information if the foundation of battle."

J.F.C. Fuller

The complexity of the battlefield has grown steadily since the rise of the Egyptian Empire in 3000 BC[1]. We have seen the Phalanx, the Legion, the Feudal Knights, Dynastic War, Nationalist War, blitzkrieg[2], and the pre-information age war of the Persian Gulf. Evolution and revolution increase the complexity of battlefield activities, organization, and command.

The signs of increasing complexity are evident throughout history. The sheer velocity of operations is staggering; during the 1941 Blitzkrieg of France, elements of the German Army attained a tempo of 31 kilometers a day[3]. During Desert Storm, elements of the US Army attained a tempo of over three times that[4]. The Signal Brigade that supported General Westmoreland in Vietnam was larger in personnel strength than any of the ground maneuver forces in country. Also, proliferation in military occupational specialties in the Army during Vietnam was unprecedented[5]. This escalating complexity inevitably triggered broad conceptual and practical changes throughout the conduct of military operations.

Battlefield complexity gave impetus to the ascension of operational art over the decisive battle and brought the effects of war into the civilian industrial hubs that fuel the Army. The battle no longer takes place only "on the front" between opposing armies. It now spans the entire theater in width and depth. This is expansion of the battlefield also expands command and control challenges.

The commander needs more information to command and control in his increasingly complex environment. His ability to get the information he seeks has increased to meet the demands. The net result is a positive feedback loop; more is needed and more is provided[6]. This unregulated positive feedback can lead to an unrestrained flow of information that alters the fundamental characteristic of the fog of war from one of a dearth of information to an overabundance of information.

Information overload can only hinder command and control because as input increases and tempo increases, decision time decreases. The commander has less time to make up his mind and yet has more information to sort through. So, how does the commander manage the information he needs to make timely and informed decisions? According to doctrine, he uses Commander's Critical Information Requirements (CCIR) his primary information management tool. CCIR includes the information the commander requires that directly affects his decisions and dictates the successful execution of operations.[7] Doctrine recognizes the criticality of CCIR by stating that the commander alone decides what is to be included in CCIR. It states that CCIR is his personal decision making information. The commander's first draft is presented after the mission analysis and is continually refined up to completion of the military decision making process and is always included in the operations order (OPORD). Doctrine states that CCIR dictates unit success. In short, doctrine provides the who, what, when, where, and why of CCIR but it fails to address the how.

While doctrine offers characteristics of CCIR and provides a definition of its sub-elements, it does not offer the commander a method for deriving it. If doctrine has not provided a CCIR methodology, do we need one? Based on the increasing complexity of

the battlefield and the decreasing amount of decision making time, it would appear that we do.

A systematic approach that integrates the apparent random behavior of complicated systems provides the commander with a tool that enables him to derive focused CCIR that is appropriate for the complex battlefield. He would identify decision making requirements that regulate the flow of information to him thus preventing overload and irrelevancy. The CCIR would become the negative feedback that stems the tide of incoming data and provides focus.

The paper reviews key concepts contained in general systems theory to define systems thinking and its approach to dealing with complexity. The paper also reviews the implications of complexity theory in relation to the information management. Information management techniques are reviewed to assess their ability to assist communication of CCIR and it ability to generate information that conforms to Licker's definition of effective information: timely, relevant, specific, accurate and useful[8]. The purpose of this section is to gain an understanding of how systems operate, how complexity impacts on them, and how information is used. This section sets the stage for an investigation of what doctrine has to say about CCIR.

Next, this paper reviews CCIR as described in current Army doctrine. It outlines what doctrine says CCIR is and how it should function. The purpose here is to assess whether doctrine accounts for key concepts found in emerging theories and disciplines; General Systems Theory, Complexity Theory, and Information Management.

A historical review looks at decision making and information management on a complex battlefield. It addresses the question of how emergent theory and CCIR

derivation might have been applied. This section assesses whether there is a need for a methodology or not.

The next section proposes a CCIR derivation methodology that enhances decision making and regulates information flow to the commander. It will applies the same standards used during the assessment of current doctrine. The CCIR methodology fulfills criteria derived from theory. It applies the fundamentals of Senge's systems thinking approach: personal mastery, mental models, shared vision, and team learning. The proposed methodology empowers *self-adaptation* and is flexible enough to adjust to changing situations. Complexity Theory is applied to determine if the proposed methodology takes into account the possibility of unexpected outcomes, it is *non-linear* and deals with multiple potential outcomes and alternative paths to those outcomes. The methodology generates decision focused CCIR that is *timely*, *relevant*, *specific*, *accurate*, and *useful*. Other information filtered and routed in accordance with information management doctrine. The methodology reduces information overload and ensures that the commander gets what he needs.

This monograph examines CCIR and its role in decision making, information management, and control in an environment of rising complexity. It explores whether we need a CCIR derivation methodology or not. It examines the nature of battlefield complexity and its impact on the commander's decision making. It explores how systems thinking and complexity theory can aid in the development of CCIR. The ultimate purpose is to determine if systems thinking and complexity theory can be applied to create a method for generating Commanders Critical Information Requirements (CCIR).

THEORY

"Theory then becomes a guide to anyone who wants to learn about war from books; it will light his way, ease his progress, train his judgment, and help him to avoid pitfalls[9]."

Clausewitz

John Casti calls the constantly increasing complication of systems complexification[10] and James Benniger says this tendency leads towards a control crises which is the battle to maintain effective control of systems[11]. Several theories have arisen that offer insight into how systems operate in increasingly complicated environments. The rise of systems analysis and growth of complexity led to the development of General Systems Theory and the Complexity Theory. A recent addition to these is the discipline of Information Management. These theories help to generate understanding of the new environment and provide insights into how to cope more effectively within it. A brief review of the critical aspects of these theories will illuminate how CCIR can be developed to aid the commander in controlling his forces on a complex battlefield.

Systems analysis rose to prominence during WWII when scientists took the lead in weapons development[12]. Weapons systems became more complicated and required specialists for their development. The radar, the Norden bombsight, and the atom bomb are examples of this new phenomenon. The development of the atom bomb required a systematic study of physics, wave mechanics, cybernetics, kinetics, and more. Transforming theoretical fission into actual fission, and the creation of a viable weapons platform, required a systems approach.[13] The systems analysis approach gained ascendancy but was not commonly understood outside of the small scientific community

that was applying it. Ludwig Von Bertalanffy changed this when he published his book *General System Theory* in the late sixties[14].

Von Bertalanffy formalized systems theory and provided the intellectual ground work in his field much as Clausewitz did in his field with the book *On War*. He described what a system is, how it is structured, how it behaves, and thereby offered a conceptual framework for breaking a system down to understand how it functions. His basic ideas form the groundwork for implementing a system thinking approach to problems such as information management on the battlefield.

A key principle of systems theory is the recognition of *wholeness*, which is the realization that a system is a combination of many parts. These parts are interrelated and interdependent, they do not act alone or in isolation. This interconnectedness implies that the behavior of the system is defined by the behavior of its parts that are hierarchical in nature since some parts are subordinate to others. The systems view provides the means to derive solutions with maximum efficiency and minimum cost by enabling the problem solver to comprehend the behavior of the systems parts [15]. Bertalanffy describes this as a "social problem solving revolution" in that it develops systematic solutions versus symptomatic solutions. A systematic solution corrects the malfunctioning part as opposed to the consequences that the malfunctioning part creates. Wholeness reveals a logical cause and effect trail when the systems parts are investigated to include their exchange of information through input and feedback[16].

Systems communicate through information exchange between its parts. This exchange of information is called feedback. These parts interact on the behalf of the whole by exchanging information with higher, lower, and equivalent level parts. This is

called *feedback*, the mechanism that regulates the system's activity. In a Bradley Fighting Vehicle (BFV), the gunner pulls the trigger to fire the chain gun. When the desired rate of fire is achieved or the target is hit, the gunner releases the trigger and the gun no longer fires. This simple exchange of information is a feedback loop. Feedback alone does not cause activity; systems have a purpose. The gunner and BFV operate in concert in order fire the gun at a target. This leads to the concept of the finality of *purpose* in systems[17].

Shimon Naveh equates purpose to the aim of the system and states that it is the systems control mechanism[18]. The goal of the gunner and BFV is to knock down a target on the range without mishap. The purpose gives meaning to the interactions of the parts by providing a reason for their behavior. They interact within the context of the purpose but are not unlimited in what they can do. The parts and their interactions are governed by a set of rules.

Systems are governed by underlying rules that regulate action in pursuit of purpose and are therefore *deterministic*. These rules are predetermined but are not necessarily overtly obvious. Relating determinism to human dynamics, Bertalanffy says that purpose is determined but not determinable[19]. In the gunner BFV system, the rules could be the rate of fire, basic load, or weapons range but these are obvious and easily comprehended. Yet, other rules that are not so obvious may have tremendous impact such as fog, humidity, weapons maintenance, or wind. Any of these factors may drastically alter the performance of the weapon for better or worse. They act as hidden rules that reveal themselves when the conditions are right. The situation becomes even more complicated when the gunner driver system joins in a live fire maneuver with a full platoon.

There are two general categories of systems and they are regulated differently. One is mechanistic and discreet while the other is dynamic and expansive. The mechanistic system is doomed to eventual death while the dynamic system may evolve in any number of ways. It is important to understand these two systems when taking a systems approach to problem solving.

The traditional *Closed System* is isolated from the environment. The closed system archetype is useful for development of machines and mechanisms that are designed to execute a specific function. Closed systems seek equilibrium or balance and are governed by entropy, meaning they cease to change once balance is achieved[20]. Closed system behavior is mechanistic and linear in that it cycles through a series of discreet interdependent steps until it reaches a stable state where it ceases to adapt or evolve. A platoon drilling on a parade ground behaves like a closed system. The platoon responds to the commands to turn right, left, halt, or advance. The action is mechanistic and lacks dynamism. Once the platoon gets it right, they quit. They do not interact with their external environment.

Open Systems are dynamic systems that interact with the environment. They are characterized by a continuous flow of information that spurs growth and adaptation. Open systems avoid equilibrium since equilibrium equals the end of dynamism. According to Mitchell Waldrop, all living systems are open systems since they interact with and adapt to their surroundings. Systems that reach equilibrium will stop adapting and will eventually fail. Open systems are nonlinear because their innumerable interaction with other systems and the environment can generate any number of possible outcomes. This systems acts to its advantage within the environment. When the drill

platoon is taken off the parade ground and is deposited into a battalion attack formation, they are forced into substantial environmental interaction. The units to their left, right, front, and rear have influence upon the platoon's behavior, as do the terrain and enemy. To understand an open system requires a detailed examination of its parts and actions.

The holistic view exposes the entire system through detailed analysis. The agents can be identified and their interactions defined. Seeing what its parts are doing aids the systems analyst in determining the purpose and rules that guide the system. *Causality* emerges by breaking the system down and then reassembling it. By leveraging his understanding of the system the analyst is able to fix the whole versus focusing on a single part. This helps to eliminate the tendency to ignore the big picture in favor of focusing on the snapshot.[21] General System Theory illustrates what a system is and how it works but it is difficult to apply using Von Bertalanffy's conceptual outline found in *General Systems Theory*. Von Bertalanffy relies on mathematical equations and hard science that is not practical or applicable in people, no quantifiable, situations.

Peter Senge offers several practical steps that enable general systems theory to be applied. He defines systems thinking in laymen's usable terms. This is the basis for his remaining disciplines that enable the use of systems theory; personal mastery, mental models, building a shared vision, and team learning. Each discipline builds on its predecessor. The individual gains proficiency, he transfers it to the organization, and the organization becomes a systems thinking unit. Before the latter can occur, the individual must develop his own systems thinking proficiency.

He begins with a *systems thinking* overview. Senge's first discipline states that a systems thinker recognizes holism, interconnectedness, and structure. He realizes that

structure influences behavior and seeks leverage by influencing the negative feedback loop, which regulates the system[22]. He executes control by identifying the systems design and by simulating its interactions to find the positive feedback loops that fuel growth and the negative feedback loops that regulate growth. The systems thinker must have the individual skill to apply holistic problem solving.

Peter Senge calls *Personal Mastery* the development of individual skill[23]. He defines personal mastery as, "the discipline of continually clarifying and deepening our personal vision, of focusing our energies, of developing patience, and of seeing reality objectively".[24] Senge's systems thinker is competent and skilled and approaches work from a creative viewpoint. The focus and development of this creative viewpoint is a natural start point for creating personal mastery.

Personal mastery is achieved through the development of a vision that provides purpose and enables subordinate creativity. The vision should focus on results, end state, and accept current reality. This requires management of the tension between the current reality and the vision[25]. The vision defines the desired end state and guides the systems thinker in the construction of paradigms that lead to goal attainment. Personal mastery enables the development of mental models, Senge's next discipline.

Mental Models are our view of how things work, they are "deeply ingrained assumptions, generalizations, or even pictures or images that influence how we understand the world and how we take action".[26] A mental model is a preconceived notion as to how things work. The belief that only rich people drive a Mercedes is not logical or inherently true but it is probably a common mental model. If we fail to reevaluate our view, systematic solutions will fail because they conflict with traditional

views. To inculcate dynamic mental models requires a love of truth and a desire for openness that invites inquiry and discourages advocacy. Mental models are tested to verify or eliminate the assumptions previously applied, therefore, mental modeling is a continuous process. Once the vision and mental models are established they must become commonly known throughout the system if it is expected to act on them. Peter Senge calls this building a shared vision.

The leader must *Build a Shared Vision,* which is the ability to create or hold a "shared picture of the future we seek to create."[27] Obviously, the picture of the future must be known if it is to be created yet the shared vision cannot be issued and left as is; it must facilitate input and interaction. Shared vision advocates partnership to encourage commitment versus compliance. Commitment implies participation by the parts of the system. The parts are active within the environment; they learn along with the leader.

Self-adaptation is *Team Learning* or tapping into the systems collective intelligence. Systems are heuristic: they learn, self regulate, and self adapt. When armed with shared vision, team learning becomes "the suspension of assumptions" and the initiation of "thinking together"[28]. The suspension of assumptions means that the leader is willing to accept challenges to his conceptions in order to gain a more accurate view and in order to see others views. This requires dialog and discussion between the leader and led so that they act as colleagues. The learning system can right itself without continuous direct intervention from the leader by adapting at the lowest levels. Once team learning is achieved, the organization has attained a collective application of general systems theory.

General systems theory can help the commander break down his tactical problem by providing a holistic viewpoint of himself, the terrain, and the enemy. The interactions

between these parts of the system will generate positive feedback and negative feedback that takes the form of information exchange. Senge's disciplines provide learning tools that can help the commander develop systems thinking within himself and his organization. These theories can be applied to CCIR by expanding the commander's appreciation of the complicated battlefield within which he operates. However these theories fall short of explaining the sometimes random nature of these dynamic systems.

Any living system is dynamic, open, and deterministic, or governed by rules. These rules are not always obvious or easily predictable. Dynamic systems adapt to changing situations and generate unexpected or unintended outcomes thereby occasionally surprising their members. Change and fluctuation are their natural state, they operation on the *edge of chaos* and require deeper explanation than is found in general systems theory[29].

John Casti calls *Complexity Theory* the science of surprise because instability is the very essence of the real world.[30] The world is a network of open systems consisting of a multitude of variables and interactions that seem random. But what is random behavior? Dice exhibit random behavior since each outcome of a roll is completely independent of previous rolls and subsequent rolls[31]. This is the opposite of linear behavior where each outcome determines the following outcome. The process of starting your car is linear; you unlock the door, insert the key, turn the key, and put the car into gear, if you can't get the door unlocked then you can't progress to the next step. Complex systems are neither random nor linear since outcomes are related to one another but are also affected by the outside environment, which can cause unexpected or divergent outcomes.

A battlefield clash is nonlinear since no series of actions can guarantee any specific outcome. There are too many variables involved to predict the precise consequences of any action. The apparent chaos is deterministic since the board and game rules guide each action. Yet there are unseen rules applied by the players that are predicated upon their mental models and more. In the military, these rules are the very nature of warfare such as battlefield physics, unit and equipment capabilities, and the moral domain of fear, fatigue, and resolve. The trick is finding those hidden rules.

Complexity emphasizes non-linearity, divergent outcomes, and surprise. At the battle of Gettysburg, a Federal Corps Commander, MG Sickles, misinterpreted or ignored his commander's instructions to tie his unit into the flank of a unit already in place and to extend his line down to some dominant terrain in the south. The Corps quickly became isolated by the ensuing Confederate attack and was decimated. The entire Federal position was imperiled and nearly overrun[32]. Clearly the Sickles never anticipated such a drastic outcome. Had he fully understood the conditions on the battlefield at the time, he would not have selected the position he ended up in.

The to avoid this kind of surprise is to develop *sensitivity to initial conditions*[33]. If Sickles had realized that the Cavalry that was supposed to screen his southern flank had been withdrawn to rest he would not have exposed his unit by occupying a forward position. This minor change was critical to Sickle's decision. Awareness of this minor adjustment introduces a certain degree of predictability and affects the outcome. These conditions act as unseen rules that influence the conduct of the game. This idea can help leaders understand how their current reality may impact on future operations but it fails to explain how a seemingly minor deviation can unhinge an entire plan.

Complexity theory states small deviations can lead to major changes in the outcome[34]. This is true because complex systems contain so many variables that they are inherently unstable. This aspect of complex systems makes long term weather forecasting impossible. Long term trends can be predicted but only short-term effects can be forecasted[35]. A small shift in wind direction and velocity, a dip in pressure, or a deviation in humidity can cause a drastic change in the weather due to magnification over time. This points to the reason that short term forecasting is possible, small changes take time to create divergence[36].

An example of a real world divergent outcome is found in the case of Mrs. O'Leary's cow. In October 1871, her cow burned down the city of Chicago[37]. Mrs. O'Leary's cow tipped over a lantern in her barn, which started a small fire that grew to engulf Chicago. History remembers it as The Great Fire, the biggest urban disaster of the time. This outcome seemed totally out of proportion with the event but not if the initial conditions are exposed. Chicago was a predominantly wooden city experiencing a three-month draught, plagued by small fires, and was being serviced by a depleted fire department. Mrs. O'Leary's cow set off a dreadful chain reaction that burned the city to the ground.

A military incidence of non-linearity can be found in the Civil War when a subunit of Confederate MG Henry Heth's Division went foraging for shoes in a small Pennsylvania town. The brigade tipped off the largest land battle in the history of the Western Hemisphere when it ran into Union Cavalry in the town[38]. Heth's unit had skirmished with Federal reserve troops before and did not suspect that the Calvary was from the Army of the Potomac. Had he been aware of Federal activity in the area, he would have avoided a major town like Gettysburg. This is another case of a minor incident

precipitating an unexpected outcome. Yet Gettysburg was not so unpredictable; both Armies were searching for one another, and each sought a decisive battle to be fought on favorable ground. Sensitivity to initial conditions would have prompted a heightened awareness of the potential for disaster and may have prompted more proactive measures.

Complexity and chaos are the tools used to uncover the determinism that underlies the apparent randomness of systems behavior. These rules empower short-term forecasting and long-term prediction of trends but cannot provide absolute certainty since approximation is possible and exact measurement is impossible[39]. The commander does not need total certainty since it is impossible to gain and hold in a complex system. He needs only to guide and empower subunits in terms of their ability to act and react. Complex systems inspire self-regulation and self-adaptation at the lowest levels where the majority of the systems interactions take place. Systems experiment and adopt successful interactions while abandoning failed interactions. Positive feedback reinforces the good while negative feedback suppresses the bad; thereby acting as the system regulator. Change is not forced down from the top, it emerges from the bottom.

The best way to illustrate feedback is to look at the human auto immune system. If it were to be prepared to fight any and all intruders, the body would have to store an enormous amount of information and antibodies to tackle any potential problems. Instead, it manufactures a multitude of molecules upon invasion and launches them to the trouble spot. When a molecule is successful in attacking the intruder it is reproduced in mass while the failures are discontinued[40]. This is akin to the reconnaissance pull technique where the commander follows the scouts through gaps as opposed to pushing them through enemy positions. This is emergence through self-adaptation.

The notions of adaptation and regulation directly apply to CCIR. If CCIR and decision points are pushed down, then small units can more easily adapt to changes based on their expanded understanding of the plan and the critical events within it. The ideas of non-linearity, divergent outcomes, and sensitivity to initial conditions combine to provide the commander with a conceptual outline that transcends the standard systems view to forecast potential unintended outcomes. The CCIR acts as a negative feedback system regulator by preventing non-critical information from being dumped into the commander's rucksack. Complexity can help focus CCIR on decision making but cannot provide the specific or practical tools that manage the flow of information.

Information management is the integrated system that provides information to support organizational functions[41]. It facilitates improvements in work quality, decision making, organizational culture, influence, teamwork, creativity, and learning[42]. Information is systematic by its pervasive nature. Information has to be managed like any other resource under the commander. The *Information hierarchy* provides the framework for effective management by defining what "good" information is and how it emerges from unrelated facts and figures.

The *Information hierarchy* clarifies the difference between data and information[43]. Data is often mistaken for, and used as, information. *Data* is raw input that means nothing until it is sorted, grouped and analyzed. Taking action based on data is speculative at best. Data enters the system as *input*, is *processed*, and becomes *output*. Decision makers need information. *Information* is grouped and organized data. The next step in the hierarchy is *knowledge* which is analyzed information. The final rung is *understanding* which is the application of education, experience, and intuition to

synthesize knowledge and generate purposive, timely, and relevant decisions. The information hierarchy clarifies the difference between data and information but does not define the roles of information. Types of information are applied in different ways.

In terms of decision making, there are two types of information: image building information enhances situation awareness and execution information that triggers decisions. *Image building* information is used to "paint a picture" and clarify understanding. *Execution information* is tied to decisions at various levels within the organization. To make decisions or comprehend the environment information has to fulfill certain characteristics otherwise it creates confusion.

Paul Licker provides desirable c*haracteristics of information.* It is *precise;* provides enough detail to describe area of concern. It is *specific;* the information is not too general and focuses on events important to decision makers. It is *timely;* it is received in time to act. It is *accurate;* it references the exact state of events it describes and is not in error. It is *useful;* it is relevant and applicable to the situation at hand. Includes the qualities of understandability, readability, and conciseness[44]. Information is useless if it cannot be communicated in an intelligible manner. Should text be used as indicated in doctrine or should some other format be considered?

The most effective form of communication is graphic. This is the concept behind Graphic User Interface (GUI), which is embodied by the Windows operating system that runs the majority of the worlds computers. Graphic presentation facilitates the communication of large amounts of complex information in a quick and intuitive format[45]. Graphic communications are holistic and non-linear since a multitude of concepts can be conveyed concurrently. The use of graphics fulfills the sage advice that

"a picture paints a thousand words". The problem is that the picture is often preceded by a thousand words that must be processed to generate it. If this data lands in the wrong lap, the entire system will slow down.

One of the curses of information systems is that they often cause *information overload.* Information overload is defined as having to make a decision within a time frame that is too short to process all the information effectively in the face of an undifferentiated flow of information. Failure to manage overload can cause the loss of time and information. An effective coping technique is *filtering* which is avoiding information from certain sources or about certain topics to allow focuses on other information. Another technique is *routing* which means that information not handled by the decision maker is sent to the appropriate people for summary and analysis[46]. Information overload is here to stay. The decision maker must find a way to cut through the data cloud to get the right information at the right time and in a useable format[47]. CCIR is the military tool that should accomplish this task. As it pairs down the influx of information, it presents the commander with the specific data he needs to make decisions. CCIR can reduce input and increase leader output particularly when it is presented as part of a decision support system.

> *"The true objective is to take the chaos as given and learn to thrive on it. The winners of tomorrow will deal proactively with chaos, will look at chaos per se as the source of market advantage, not as a problem to be got around. Chaos and fleeting market anomalies will be the successful business's greatest accomplishment[48].*
>
> *T.J. Peters*

Decision Support Systems (DSS) help leaders track down the right information[49]. A DSS assists in problem description, modeling, evaluation, and execution. Most decisions

are semi-structured meaning they are ill defined, non-routine, and cannot be mechanically derived. The problem and its parameters are recognized but the outcome cannot be determined mechanically. The DSS collects and presents relevant information to the leader by highlighting critical events and specific criteria *the decision maker has identified* as crucial to his ability to render a timely and relevant decision that can become action. To create a DSS requires user active participation in defining the problem and identifying potential solutions.[50]

To make a DSS that works, the information management system must determine the decision maker's requirements. A detailed analysis of system components and interactions results in the creation of the *Decomposition Diagram,* which breaks the unit down into discreet parts, and the *Entity Relationship Diagram (ERD),* which defines specifically how the parts interact. These become the parameters of the DSS. Next, you need to know what you need know! To find this out, the information manager must break the system down to see how it works.

The information manager breaks down the system to identify what it needs to function properly. He organizes multi-functional teams to solve information problems. These teams span the spectrum of the environment. They construct *decomposition diagrams* to isolate processes based on user input[51] and generate *entity relationship diagrams* that illustrate systems interaction and feedback[52]. From these, they determine real requirements and develop a DSS to meet them. A DSS that implements information management, systems theory, and complexity would be comprehensive, predictive, and intuitive which is the ultimate goal of CCIR.

Systems theory describes the environment while Peter Senge's provides guidelines on how to operate within the environment. Complexity theory explains apparent random behavior expressed as divergent outcomes and provides cognitive tools for discovering their underlying causes. Information management provides concrete methods that facilitate information handling, tailoring, and communication. All of the above can be applied to CCIR to make it more efficient and effective if required. The question is whether or not doctrine applies these theories, and for that we must turn to doctrine as the embodiment of the practical application of theory.

DOCTRINE

This section focuses on CCIR in doctrine to look for potential gaps that theory may be able to address. Doctrine is clear on the who, what, when, where, and why of CCIR but says little about how. The reviewed Field Manuals (FM) are: FM 100-5 *Operations*, FM 101-5 Staff Operations, FM 101-5-1 *Operational Terms and Graphics*, FM 100-6 *Information Operations*, FM 34-3 *Intelligence Analysis*, FM 34-8 *The Commander's Intelligence Handbook*, and FM 34-130 *Intelligence Preparation of the Battlefield.* These are the core references used in the schoolhouse and in the field and provide the best view of what doctrine has to say about CCIR.

The manuals agree on who is responsible for CCIR; the commander is ultimately responsible. FM 100-6 states that the commander determines CCIR alone although staffs may make recommendations[53]. These statements imply that the commander generates his own CCIR and reviews staff recommendations. The staff manual, FM 101-5 states it is situation dependent and is specified by the commander.

Doctrine is consistent on what CCIR is; the critical information required for decision making. FM 100-5 states that the commander will be flooded with information used for visualization and decisions making[54]. It states that he must know if to decide, then, when and what to decide. FM 100-5 does not directly reference CCIR but the above statements imply the anticipation as essential in complex environments and points to the need for information management to prevent overload[55]. The information operations manual is more concrete on the definition of CCIR.

FM 100-6, *Information Operations*, integrates CCIR into almost every chapter while reinforcing a few basic themes on what it is; CCIR is commander's business, its crucial, and it enhances decision making. Well constructed CCIR prevents information overload, enhances tempo, is dynamic in nature, and cannot be a fixed concept[56]. This incorporates information management to filtering to reduce overload and systems theory's notion that open systems are adaptive. FM 100-6 reinforces information management theory by stating that CCIR must be precise to be responsive. The manual implies that it should be adaptive and states that it focuses on the commander's visualization of the sequence of events and their role in moving him from his current situation to his desired end state [57]. This last statement ties in nicely to Senge's personal mastery and mental modeling. It also reinforces the definition provided in FM 101-5-1:

> **Commander's Critical Information Requirements (CCIR)** - Information required by the commander that directly affects his decisions and dictates the successful execution of operational or tactical operations. CCIR normally results in the generation of three types of information requirements; priority intelligence requirements (PIR), essential elements of friendly information (EEFI), and friendly forces information requirements (FFIR).
>
> FM 101-5-1, p. 1-34.

The doctrinal definitions of CCIR are well coordinated with theory in terms of what

systems are, how they operate, how feedback loops work, and what the role of information is in decision making. They also relate well to Senge's development of system thinking. Senge indicates that personal vision should be developed before building shared vision.

Only two manuals give a discreet time when CCIR is developed. FM 101-5 and FM 100-6 state that CCIR should be formulated by the commander early on and should be validated by the staff during the military decision making process (MDMP). Early on appears to be during the mission analysis portion of MDMP. This validates Senge's notion that personal vision must be developed before attempting to build shared vision. Doctrine is pretty clear up to this point but the subject of where to find CCIR is less concrete.

Only FM 101-5 showed where CCIR is found by stating that CCIR is time sensitive and is always included in the operations order (OPORD).[58] It is found in the coordinating instructions of the execution paragraph of the OPORD. Example orders present it as a list of questions that should be answered during the operation. CCIR also appears in mission analysis step eight of the mission analysis outlined in FM 101-5.[59] The discussion of where CCIR is found and how it is presented falls short of the information management principle of using graphic representation to enhance understanding and linkages.

While FM 101-5 shows where CCIR goes in the OPORD, it does nothing more than the provide a space for a list of questions[60]. It does not offer an effective communication method. The format does not tie the decision to the CCIR that triggers it. The linkage

between the decision and the CCIR is similar to the linkage of the purpose to the task, it relates a why to the what which enables initiative.

Doctrine is consistent on why we develop CCIR. The main reason is that it is a decision making tool for the commander. Only FM 100-6 spends a detailed amount of time and space explaining this concept. It states that CCIR is so central that it guides the set up and functions of the entire Command, Control, Communications, Computers, and Intelligence (C^4I) system. FM 100-6 further emphasizes that to gain and seize the advantage in battle, the commander must master two essential features of information dominance; CCIR and tempo. This reinforces the theoretical concept of purpose and determinism in guiding the actions of systems and their parts. Its information management role is also addressed.

FM 101-5 identifies why CCIR is important. It states that a critical function of CCIR is to act as a filter to reduce the volume of the information flow. FM 101-5 suggests that the optimal number of CCIR is 10 or less since this facilitates ease of tracking and focuses the staff.[61] This incorporates the information overload techniques of filtering and routing.

The manuals are pretty clear on the who, what, when, where, and why, but have left much to the imagination as to how. The intelligence series of manuals is a good place to look for how since they deal with information gathering and decision making in more intimate detail than the other manuals do.

The intelligence series of manuals are surprisingly quiet on the topic of CCIR in its totality. This is unexpected since the goal of Intelligence Preparation of the Battlefield (IPB) to support military decision making[62]. CCIR does not make it into the table of

contents or index of any of the intelligence manuals reviewed for this section. They do emphasize Primary Intelligence Requirements (PIR), a sub component of CCIR. They state that PIR are intelligence requirements needed by the commander for his decision making. FM 34-3 states that the intelligence officer determines the PIR and the commander approves them[63]. FM 34-8, *The Commanders Intelligence Handbook*, is less categorical in stating that the commander may select or approve PIR [64]. Only FM 101-5 actually allocated space for the communication of CCIR. The intelligence manuals offer some tools for partial communication of CCIR.

Only the intelligence manuals present any tools for decision support communication. The best presentation tools offered are the Decision Support Template (DST) in FM 34-130, 34-8, and 34-3 and a description of the Decision Support Matrix (DSM) found in FM 34-3 and FM 101-5.

A critical decision support tool is the DST however it is not a comprehensive CCIR tool . The DST depicted in FM 34-3 and FM 34-130 is a cartoon of simplified friendly and enemy graphics with decision points and named areas of interest interposed between.[65] FM 34-3 adds targeted areas of interest and timelines to the graphic. Neither specify adjacent unit actions, critical control measures, friendly forces information requirements (FFIR), or essential elements of friendly information (EEFI). Both manuals attach a matrix to the DST diagram, which is a slice of the Battlefield Operating Systems (BOS) synchronization matrix. None of the manuals depicts a DSM. Only FM 34-3 defines one and its definition does not include a description of the decision or the inclusion of FFIR and EEFI[66]. FM 101-5 references the DSM on two pages but when the pages are reviewed the DSM is absent. The synchronization matrix is mentioned in the

manual but the DSM is not. Since it is not their purpose, none of these manuals offers a comprehensive CCIR communication tool in graphic form, as a relational table, or as a matrix. Information management indicates that decision support systems should present data in a manner that facilitates timely decision making and offers some tools for derivation of specific requirements. Doctrine is lacking in the communication of CCIR and does not fare much better in explaining its derivation.

None of the manuals reviewed offered a method for CCIR derivation. The doctrine lacks the cognitive link between what CCIR is and how it is uncovered and communicated. If you are given a box of parts and a picture of what they are supposed to be, but have no instructions, it is questionable whether you would assemble it properly. CCIR was not part of Army doctrine during Vietnam, so a historic analysis from that war illustrates the cost of fighting without it and assesses the need for a methodology[67].

HISTORICAL ANALYSIS

"In the art of war experience counts for more than any number of abstract truths."

Clausewitz

Vietnam was America's last long war and, in many ways, it was its most complex war. It involved guerrilla war, conventional war, and an invasion, all against the backdrop of the Cold War. Vietnam provides the historical backdrop used to assess military decision making under fire. This analysis focuses on the Ia Drang battles of 1965. It shows that adaptation, anticipation, and information management were not effectively used by American leaders. Their thinking was linear, they did not consider initial conditions or divergent outcomes. Had the American commanders been cognizant of the system they were in, they probably would have fought much differently.

On 15 September 1965, the 1st Cavalry Division landed in Vietnam. By the middle of November they were engaged in the war's first battle between US forces and the Peoples Army of Vietnam (PAVN).[68] The Ia Drang saw the first full scale air assault, B52's used in close air support, and battle where no ground was exchanged. One of every four Americans engaged in the Ia Drang ended up as a casualty.[69] An early fallacy was the failure to take note of recent significant activities and assess the current situation.

LT Henry Herrick, a platoon leader in LTC Hal Moore's Bravo Company of the 1/7 Cavalry, had earned a hard charging reputation back at Fort Benning when he had forced a weak swimmer to do a river crossing. The soldier drowned and Herrick's platoon sergeant asked for a replacement claiming the lieutenant was too gung ho. His request was rejected and within weeks the unit deployed to Vietnam[70]. Had Moore and Herrick's company commander, CPT Herron, been more sensitive to the young officer's excessive audacity things on Landing Zone (LZ) X-Ray may have been quite different. This lack of attentiveness was not exclusive to the battalion level.

In the 3rd Brigade, home of Hal Moore's 1/7 Cav, COL Tim Brown gave LTC Robert McDade command of the 2/7 Cav. McDade had been the Division G1 and last led troops 10 years before. MG Harry Kinnard seemed to be unsure of his staff favorite so he sent his aide along to serve as McDade's XO and to overwatch him until he got his feet on the ground[71]. McDade was unseasoned yet his command would begin in Vietnam. As in the case of Herrick, a key leader would be at the critical place, at the critical time, but would execute poor judgment. The leaders of the First Cavalry Division did not pay attention to the initial conditions that placed several weak leaders in critical spots and they continued this pattern by failing to pay attention to enemy activities preceding the battle.

The initial conditions in the Ia Drang indicated a battle on the horizon and offered a glimpse of the underlying rules that would govern it. A battle occurred at Plei Mei a few weeks prior to the Ia Drang. During the fight the PAVN established their tactical pattern. They threw themselves on the Plei Me outpost, endured tremendous punishment from air and artillery, and then ambushed the relief columns.[72] They hugged US forces to mitigate U.S. firepower and to lure relief convoys into deadly ambushes. Following the battle, the mauled enemy regiments limped back to the Chu Pong Massif.

During their retrograde, the PAVN ambushed a Cavalry (Cav) column, they destroyed a PAVN weapons cache, and over ran a PAVN regimental hospital. The hospital yielded significant intelligence that included PAVN infiltration routes and unit identifications and locations on Chu Pong.[73] Lieutenant Colonel Moore and Colonel Brown viewed the intel maps from the hospital together. Moore noted the command post (CP) of the 33rd PAVN Regiment (Regt) at the base of Chu Pong. Neither leader seemed to take much note of this information since it was to become the future sight of Landing Zone X-Ray where Moore's unit would fight..

On November 12th COL Brown, 3d Brigade Commander, ordered LTC Moore, the 1/7 Cavalry Commander, to search the Chu Pong Massif for the enemy. LTC Moore had forty-eight hours to prepare yet he failed to *anticipate* the environment. He did not insert his scouts to find the enemy or overwatch the LZ.[74] He restricted his reconnaissance to an aerial search for the optimal LZ based on physical capacity of the open area. His mental model of the enemy did not assume that they might attack him rather than allow him to attack them. He did not consider enemy proximity to the LZ or friendly time to mass on the LZ. The grid he selected was only 500 meters from the regimental

headquarters he'd seen on the intel map earlier. Two more PAVN regiments and a VC battalion were less than an hour away. This was a terrible place to land with only one battalion.

On *14 Nov, 1965,* LTC Moore initiated his assault with a thirty minute artillery preparation of the LZ followed by an eight ship lift carrying B/1-7 Cav and the battalion headquarters. These actions alerted the PAVN of impending action and the field force commander immediately ordered a three-battalion attack. The *divergent outcome* was that the enemy moved to Moore rather than away from him in spite of their battle worn condition. It seems incredible that this response was not predicted. The explanation may lie in the relative "newness" of the air assault form of war or it may simply be due to a casual approach to battle that is not uncommon among units new to actual war. In either event, the enemy's actions would not bode well for the lead company on LZ X-Ray.

Moore immediately initiated the attack up the Chu Pong Massif with Bravo Company and LT Herrick. Bravo captured two PAVN soldiers who revealed that there were at least three NVA battalions on the mountain that wanted to kill Americans.[75] Moore failed to adapt to this new information; he should have aborted.

CPT Herron continued the attack and ran into 250 attackers when Herrick became encircled and cut off.[76] He had pursued some enemy soldiers and had gotten out in front of the company only to be surrounded. This could have been predicted given Herrick's reputation for pushing too hard. The battle intensified and Moore could no longer accept any more than six birds on the LZ. He lost the size advantage of LZ X-Ray[77]. It took 1/7 Cav 5 ½ hours to close on the LZ.

Late in the day Moore realized he needed reinforcement to hold the LZ and rescue his lost platoon[78]. Brown had put a company on alert and prepared an additional battalion for reinforcement. None of these actions were pre-planned and therefore arrived too late to help Herrick. 1/7 Cav had to defend for the night. That night Moore's operations officer identified lights on the mountain that he believed belonged to guides leading enemy units to the fight[79]. If the enemy situation and disposition had been considered and an accurate mental model had been constructed, this would have been projected as possible.

By 0800 hours on the fifteenth, LZ X-Ray was under attack from three directions[80]. Reinforcements arrived and the 2/5 Cav under LTC Walter Tully was on move to back up Moore. Tully was supposed to arrive in the morning but did not close until noon, they were late but they enabled Moore to rescue the lost platoon. The constant tardiness of reinforcements is further indication of a lack of systematic analysis of the environment and the sub-components working within it. Moore's force was now up to nine companies restricted to the defense and backed up by heavy fire support[81].

At 0400 hours on the sixteenth, the NVA initiated the first of three assaults. The enemy assaults were defeated due to excellent use of fire support. At 0655 hours Moore ordered a "mad minute" reconnaissance by fire, a tactic that would become common in Vietnam[82]. He then expanded his perimeter by 500 meters.

LTC McDade's battalion, 2/7 Cav, finally arrived from LZ Victory, having been ordered into the fray by COL Brown. They were too late to influence the action but they joined Tully's troops in relief of Moore.[83] They were exhausted and settled in for a quiet night that helped to build a false sense of security.

On the fourteenth, COL Brown ordered Tully to move out to LZ Columbus and McDade to head for LZ Albany[84]. Each was to sweep their area for enemy troops enroute to their destination. Tully, a seasoned commander, marched behind a moving artillery barrage while McDade led a casual road march to Albany[85]. McDade's lack of experience coupled with his unit's exhaustion created a general lack of vigilance[86]. Brown's orders did not create a shared vision in that they could be construed as implying a safe passage. Once again, he was not sensitive to the initial conditions: McDade's inexperience and his units fatigue. Lastly, the unit failed to learn from the PAVN tactic of ambushing relief columns that was employed a few weeks prior at Plei Me.

About 200 meters from Albany, McDade's lead unit captured two NVA soldiers. He stopped the column to interrogate them and called his commanders forward. Just as at X-Ray, the capture of enemy troops indicated others nearby and ready to attack. They were scouts for the 8th Bn of the 66th Regt that had detected McDade and had hastily deployed into an "L" shaped ambush[87]. They were preparing to spring their trap.

Within thirty minutes of the capture, the ambush was initiated. At least 150 soldiers were killed in the initial volley[88]. McDade thought the entire action was a fratricide and ordered a cease fire[89]. He was wrong. Brown was monitoring McDade's traffic and discounted what he was hearing as hysterics. He prevented his command post from sending updates to division and ordered CAS in on 2/7 Cav without coordination[90]. He violated team learning by abandoning the dialogue that clarifies the vision.

Brown postured reinforcements around McDade but did not commit any to direct support. By nightfall, the battle had degenerated into a squad action with enemy soldiers

roaming the battlefield executing the wounded[91]. Only the indirect firepower finally drove them off. The scene was one of disaster.

When the sun came up on the eighteenth, the 2/7 Cav had suffered 155 dead and 125 wounded, more than double the 79 dead and 121 wounded suffered by Moore during the three days of X-Ray. Moore's apparent victory had been balanced by McDade's apparent defeat. The press called Albany a massacre in spite of the fact that over 450 NVA had been killed[92].

The division commander and assistant division commander had been kept in the dark throughout much of the operation[93]. MG Kinnard, the Division Commander, asked COL Brown what he was doing on Chu Pong during X-Ray and BG Knowles, the Assistant Division Commander, was aghast at 2/7 's losses. They had no inkling of the scope of the fight as it occurred and only got wind of how serious things were from the press reports of a disaster. Knowles actually consulted a personal spy at graves registration to keep abreast of friendly casualties[94]. He was mystified at not having been called for help since he claimed to have had ample reaction forces at his fingertips with which he could have responded. That such key decision makers excluded from the loop indicates that the 1st Cavalry Division did not have effective information management.

LTC Moore, LTC McDade, and COL Brown did not anticipate any of the decisions they made in the Ia Drang.[95] The entire brigade lacked systems approach and shared vision. Moore discounted Herrick's inexperience and recklessness prior to the initial attack on X-Ray[96]. Brown made the same mistake regarding LTC McDade's inexperience[97]. The mental models were inaccurate and untested by reconnaissance.

The mental model of the enemy was inaccurate and non adaptive. They did not adapt to include the Plei Mei enemy tactics of hugging, baiting, and trapping[98]. The ambush on Albany was consistent with the PAVN propensity to ambush relief forces the intelligence captured at the PAVN hospital went unused[99].

LZ X-Ray was too close to plotted enemy positions and battlefield physics would have shown that the enemy could mass more quickly than the Cav. The Cavalry did not plan for alternate LZ's or execute false insertions to upset enemy predictions and timelines. COL Brown could have initiated a multi battalion mission and should have had abort criteria. Like his boss, LTC Moore did not plan ahead or adjust to the situation.

The unit did not learn, anticipate, or adapt during the battles of Ia Drang. Hal Moore had sixteen helicopters to move his Battalion and it took him 5 ½ hours to close the Battalion[100]. He had to wave off several lifts and could only maximize the LZ on the first lift. Moore did not track aircraft and pilot availability or enemy air defense capability. They were a critical part of his system.

Neither Moore nor Brown planned for reserves consequently, no back up force was in place[101]. Alternative courses of action were not prepared therefore, reinforcements were cobbled together from available units to be committed piecemeal. The culmination of the battle was at the behest of the PAVN. They did not plan a sequel that was guided by a dominant concept for victory. Moore and Brown failed to plan and think ahead but their counterpart, LTC McDade, failed to do anything but react.

McDade failed miserably in his mission. He made no discernible efforts to maintain security enroute, to plan alternate routes, alternate landing zones, use of reserves, actions on contact or anything else[102]. He and COL Brown did not share a common vision about

the mission. McDade thought he was simply moving to a pick up zone while Brown expected him to "sweep" the area between X-Ray and Albany, implying the potential of combat. Brown did not ensure that he and his commanders had a common picture and he blocked the flow of information to division[103]. Brown had numerous combat multipliers at his fingertips yet he employed them reactively and often too late. He seemed to abrogate all planning responsibility to his subordinates. A decision support system fueled by CCIR could have helped in the Ia Drang.

CCIR could have been used to identify abort criteria, use of reserves, triggering contingencies, transition to sequels, and employment of key combat multipliers. The abort criteria could have been outlined in terms of enemy strength and proximity to the LZ, friendly aircraft status, time to build combat power relative to the enemy, location of supporting systems, and time to reinforce. A complicated environment like the Ia Drang, calls for CCIR that is derived carefully using a deliberate methodology.

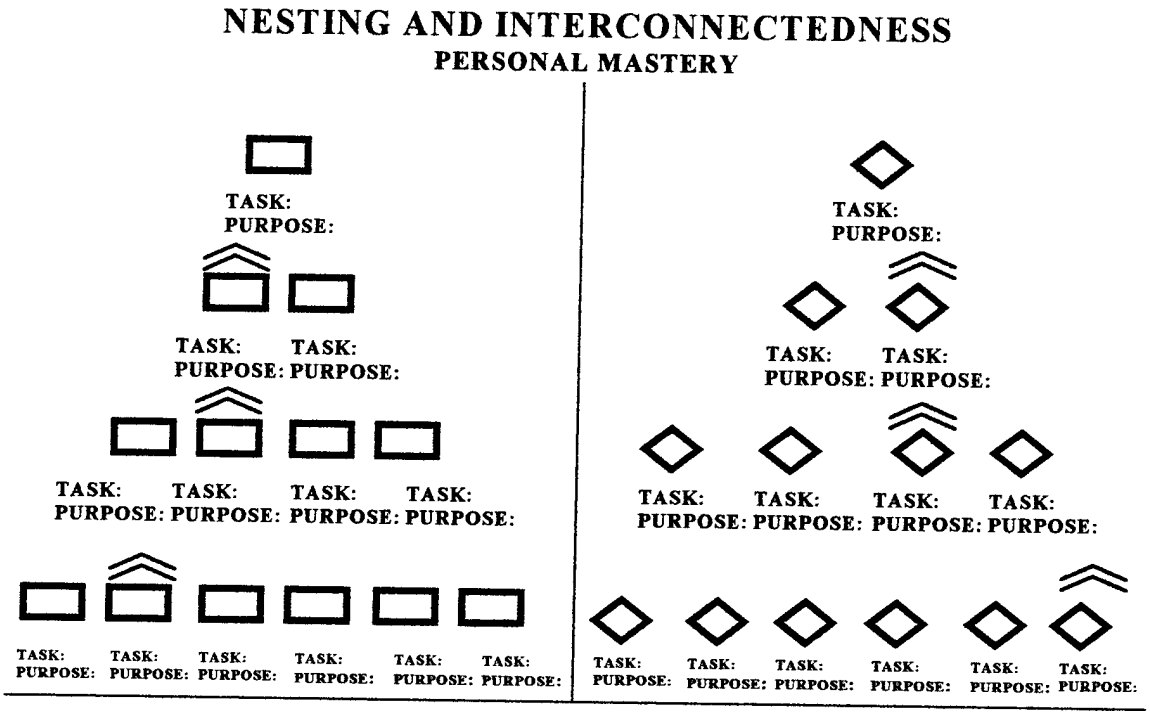
ANALYSIS

> *"Military commanders ... need to detect leverage points. A skilled commander is able to study a map and quickly detect the leverage points. Leverage points are just possibilities... leverage points provide fragmentary action sequences, kernel ideas, and procedures for formulating a solution...we also need to spot leverage points that can work against us, in order to learn the weaknesses in our plans."*[104]
>
> *Gary Klein*

A series of theories have taken shape to explain rising complexity and to offer ways to maintain control within the changing environment. Systems thinking is required to compete in today's world and CCIR is a critical part of the system. It clarifies the commander's vision by describing his anticipated decisions and the information that will contribute to them. Doctrine tells us what must be done but not how to do it. A CCIR

derivation method is needed, not to become a lock step laundry list but to provide the intellectual tools that connect the CCIR to the commander's intent and to regulate the flow of relevant information.[105] As one General Officer put it, "*People say we will be overloaded by the incoming information, I say that's hogwash; the problem is we ask the wrong questions*[106]." To ask the right questions, the system needs to be reduced down to its lower parts and their goals must be identified.

The first step is to *nest* the *tasks and purposes* of the enemy and friendly forces. This

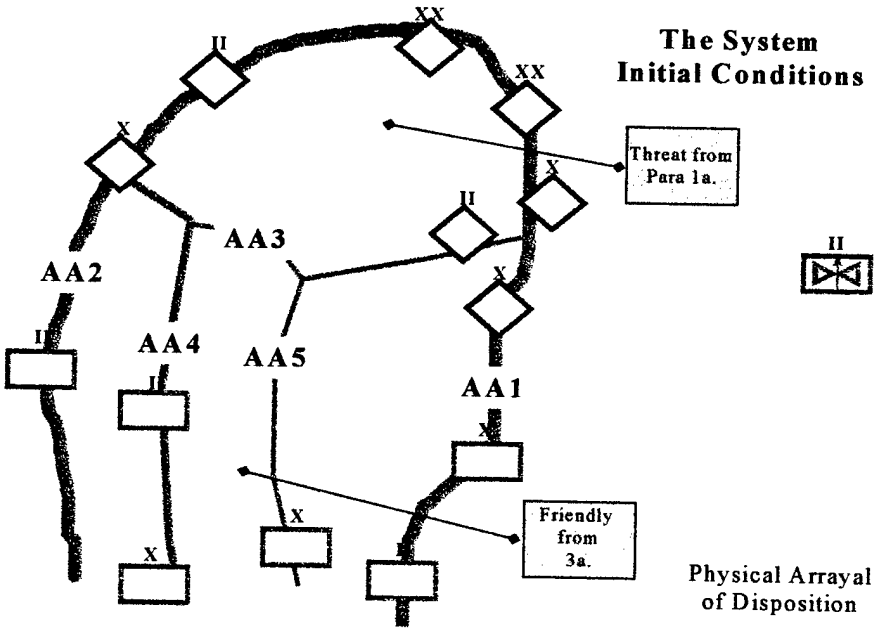


step breaks the system down into its component parts and acknowledges the presence of opposing systems and whose behavior is tied to their structure and purpose[107]. Information management calls this decomposition, the identification of systems parts and definition their relationship to one another within the hierarchical structure. The commander uses his operations order to find the tasks and purposes of his unit, higher,

and adjacent units. This clarifies the main effort and how supporting efforts contribute to its success[108]. This requires personal mastery since the commander must accomplish the same result in terms of the enemy force using his emerging vision to guide the process.[109]

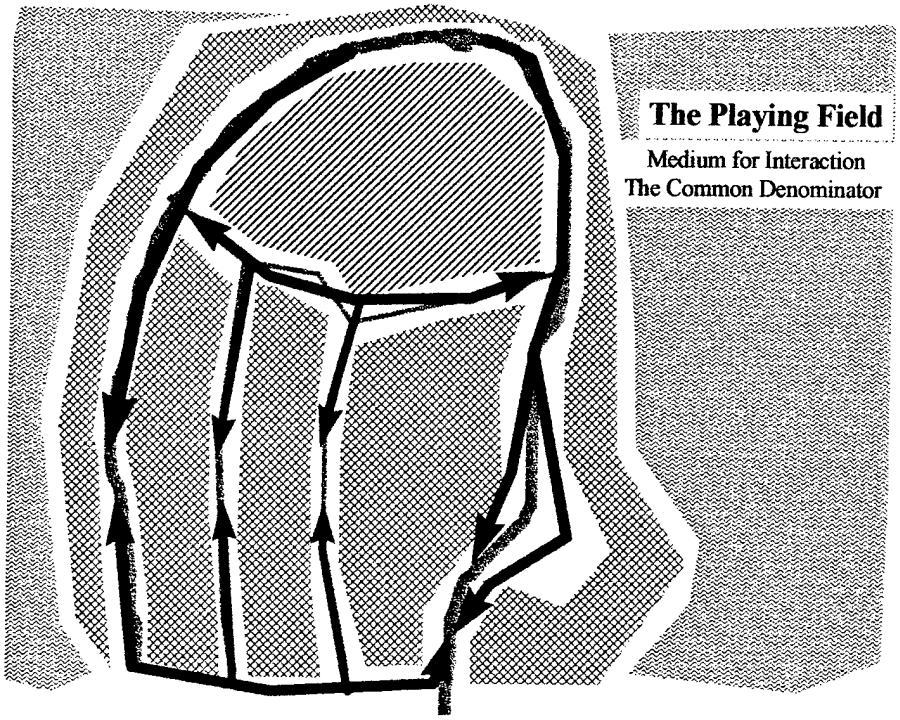
The commander *builds concept sketches* incorporating his nesting diagrams. This is the first step in developing mental models[110]. A simple sketch follows the concept of using graphic representation to simplify the presentation of complex information and development of sensitivity to initial conditions. Matching the words to the picture develops cognitive clarity and helps the commander identify facts and assumptions. The sketch becomes a nonlinear depiction of the contesting systems but they are not independent.

The sketches represent open systems since they interact with the environment, therefore the commander must place his sketches onto a map. This helps him gain an appreciation of the physical disposition of forces, which implies potential purpose. He now has a general model of where forces are accompanied by their potential purpose,



which indicates where they want to go. The commander selects the most probable purpose based on the information available but the sketch also highlights other potential purposes that he can collect against. The mere realization that other potential purposes exists heightens awareness and focuses collectors against the indicators that identify the purpose chosen by the enemy commander. The next step is to derive potential routes that can transition forces from their current state to the state that fulfills ultimate purpose.

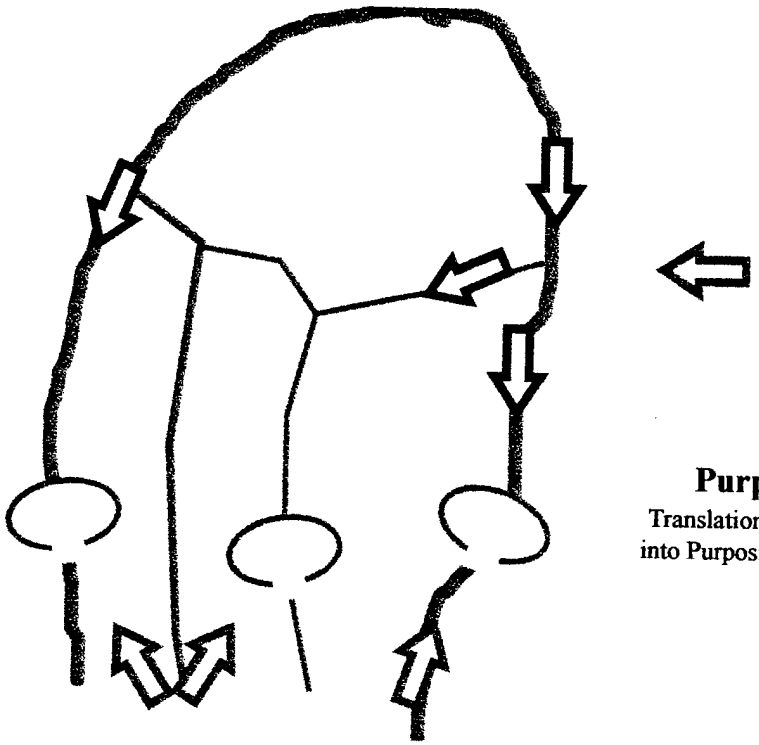
The commander must complete a *simplified terrain analysis* to assess the playing field upon which the two systems will compete[111]. He does not do a complete obstacle overlay, rather he focuses on mobility corridors and avenues of approach as the potential paths that allow the transition from the initial condition to the desired end state as driven by purpose. [112] The commander must complete this step on his own if he is to complete his mental model and develop guidance for the staff in a timely manner. If he waits to be briefed, he will issue incomplete guidance, develop faulty models, or make the staff wait while he integrates their analysis into his concept development. The completed picture becomes the basis of mental modeling.



The commander refines his mental models by *developing conceptual courses of action for the enemy forces and his own forces.* These are tentative and non exclusive and simply reflect the commanders choice as to what is most likely given the situation. He uses his knowledge and experience to select what appears to be the best methods to achieve the given purposes.

The commander applies his enemy nesting diagram and mobility options to create a potential course of action for the enemy force. Their proposed purpose, their physical capabilities, and the routes available guide him. He considers likely alternatives and keeps sight of the fact that this model must interact with the friendly system and the terrain. This is key in the development of the friendly course of action.

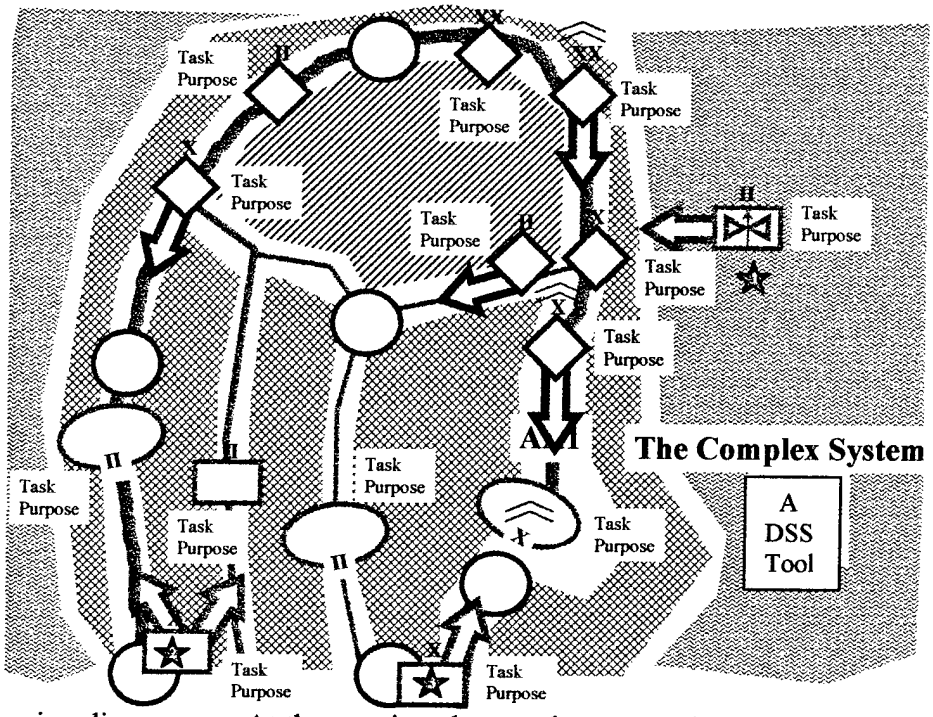
Using the enemy model as his biggest assumption, the commander develops his friendly course of action. He assesses his task and purpose relative to his higher headquarters, adjacent units, and the enemy looking for the linkage between his unit and the main effort, the supporting efforts, or both. The system is regulated by physical



Purpose
Translation of Tasks into Purposive Action

abilities so the commander assesses his capabilities, requirements, and shortfalls. The commander arrives at the determination of his purpose and relates this to the enemy and the terrain to find the most likely route to achieve the desired end state driven by the purpose. He then works through the steps that will transition him from current reality to the goal.

The commander mentally traces the path his system and its parts must follow outlining a potential sequence of events that achieves the desired end state. He begins to compile a list of significant factors and critical events that may evolve into CCIR. These are dependent on the initial condition and are points that may force him off the proposed



path causing divergence. At these points, he may have to make choices as to how to continue. This extends decomposition by interrelating the components of his system. These mental models are the basis of building vision but they are still closed systems at this point.

To build a shared vision the leader must test his mental models, suspend his

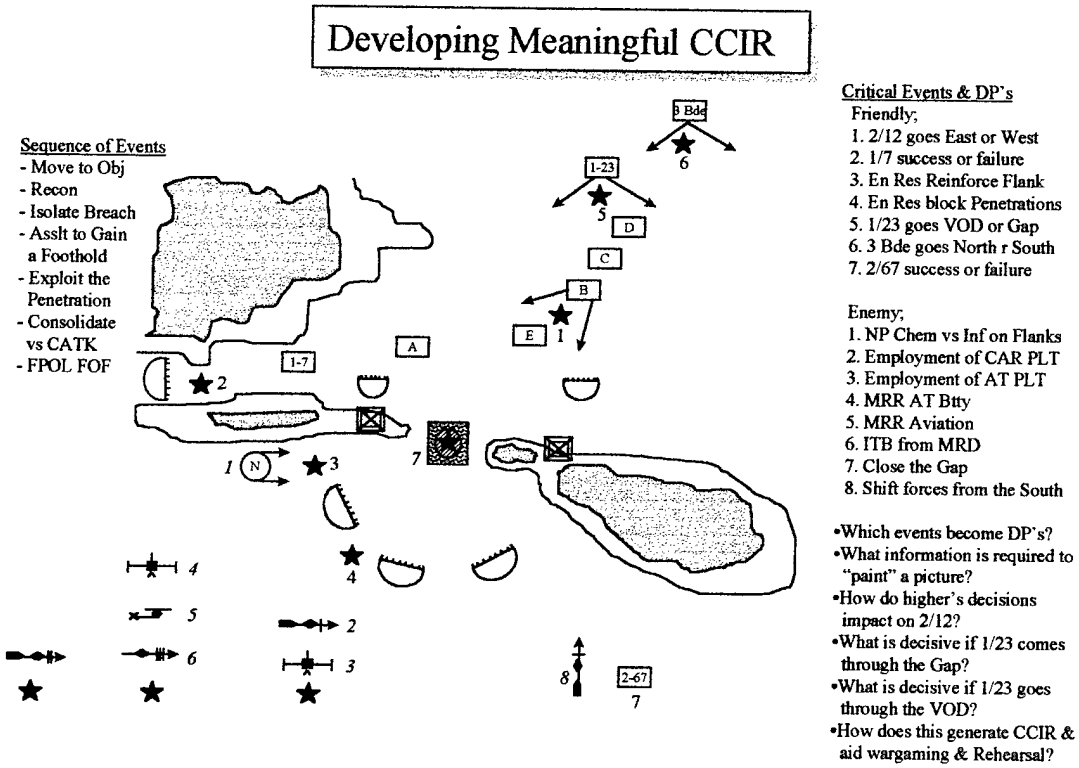
assumptions, and cause the models to interact, as open systems do, with each other and the environment. This requires a heuristic strategy called mental simulation, which is the ability to imagine units in their current state, transition them through a sequence of events, and end up picturing them at their end state.[113] This is the commander's analysis or wargame. It the critical step that generates the vision and generates his initial CCIR.

The commander anticipates his decisions and the enemy's decisions as he maneuvers his model through its sequence of events towards its end state, opposing it all the way with the enemy model. Each is driven by its nested purposes. Decisions that do not conform to the proposed purposes must be over watched since they indicate another purpose. The time, place, and activity are noted and the area is assigned to a subunit for observation. The commander must be honest with himself in his analysis just as Senge advocates. Once the mental simulation has achieved the desired end state, the commander looks back on the drill to determine where his system and the enemy system were, or could have, been forced to adapt. This becomes a mental after action review where the commander assesses the mission in terms of key decisions made by each model based on his ability to preview the situations as being familiar[114]. These points of adaptation where change did occur or was likely to occur are the focus of CCIR development.

The commander is looking for the critical points.[115] Critical points are also known of as leverage points or, in military parlance, as decision points.[116] Decision points are choice points where the decision maker has viable options at his disposal, where he must decide. The decision points are used to develop alternate courses of action for friendly and enemy forces and are used to uncover points of potential vulnerability. The exposure

of friendly and enemy decision points is critical to the development of the commander's vision and CCIR derivation.

The commander zeros in on each potential decision and uses the "if, and, then" technique to generate his draft CCIR based on the time and place where his anticipated decision occurred in the model. He identifies enemy actions, primary Intelligence Requirements (PIR), and friendly actions of his or adjacent units, friendly forces information requirements (FFIR) that directly impact on his decisions. He then determines what he must conceal from the enemy to prevent disruption or preserve surprise, essential elements of friendly information (EEFI). He develops a full set of PIR, FFIR, and EEFI for each specific decision point.[117] This is holistic, interrelated, CCIR that is based on complete mental models that are purposive in nature. The commander is



now prepared to build a shared vision using his analysis and preparation products to issue guidance to focus the staff.

The purpose of mental models is to provide the commander a frame of reference for developing his vision. The staff will confirm, deny, or refine, these concepts during the rest of the planning process. They develop alternate and most dangerous courses of action for the enemy and alternate courses of action for friendly. This is in the spirit of Senge's shared vision and team learning due to its emphasis on discussion and dialogue.

A shared vision is characterized by the ability to create or hold a "shared picture of the future we seek to create."[118] It is accomplished through the communication of the derived CCIR and the integration of staff input. The commander clarifies his perception of where the unit is and where he wants it to go. Following the mission analysis brief to him, he issues focused guidance based on his nesting, COA development, personal wargaming, and CCIR development. The commander focuses the staff's efforts yet allows them to pursue divergent courses. The guidance ensures his courses of action and decisions are addressed. The staff work adds detail and expertise that enhances the commanders analysis. He and staff collaborate to produce the final product and joint ownership of the final plan[119].

At this point, the shared vision is still restricted to the commander and staff. The commander developed his concept while the staff performed mission analysis. He and the staff must share their analysis and the commander must pass his vision on for further planning and development into unit vision. For the commander's vision to become a unit vision it must be effectively communicated to facilitate team learning, adaptation, anticipation, and emergent control from the bottom[120]. Written CCIR falls short of the

mark. It is linear and non purposive in the format found in doctrine. CCIR must be directly tied to each decision. This adds purpose to the PIR, FFIR, and EEFI, as opposed to being a laundry list of questions.

A graphic, intuitive, decision support tool that ties CCIR to each decision enables subordinates to recognize decision points. It communicates the complex notion of vision in an economical manner. Graphic tools enhance the purposive control by using CCIR as the underlying rules and as the negative feedback loop that regulates and routes information flow[121].

This methodology accounts for complexity, systems thinking, and information management. It will reduce information pathology, the search for certainty that is impossible in a complex system, and accepts the notion that complex systems defy exact measurement.[122]. Approximation and short-term prediction are possible given a systematic analysis and development of sensitivity to initial conditions

This methodology facilitates adaptability, non-linearity, and anticipation through its acceptance of divergent outcomes [123]. This system is holistic and systematic since it breaks down both systems and puts them in opposition within the context of their purposes. It acts as a decision support system to provide information that is timely, relevant, specific, and useful since this information was derived by the decision maker himself in direct relation to the decisions he has predicted. It facilitates team learning by providing the force with the commander's vision, his projected decisions, and the requirements that trigger those decisions. In the end, team learning is the realization of systems thinking on the battlefield.

CONCLUSION

"... the safety of this nation... cannot lie wholly or even primarily in its scientific or technical prowess."[124]

J. Robert Oppenheimer

Increased complexity has increased the information demands of tactical commanders. Technology can now meet the new demands thereby generating even more demand. This positive feedback loop hyperactively overproduces data[125]. Its destabilizing effect is the retardation of decision making rather than enhancement of it[126]. A CCIR methodology is critical for the management of information in a complex environment.

The best way to cut through the fog of information excess is to ask the right questions. The commander does not need to know everything since junior leaders make most combat decisions but the commander should reserve a few key decisions for himself[127]. He should focus his CCIR on the critical decisions he has identified.

Large scale employment of focused CCIR requires changes in doctrine, training, and organization. The conclusion addresses some of the potential changes.

"The true general is not a mere prompter in the wings of the stage of war, but a participant in its mighty drama[128]*."*

JFC Fuller

Current doctrine does not emphasize the commander's personal role in the derivation and its use as a tool for provision of guidance and creation of shared vision. Doctrine should emphasize the commander's pivotal role in guiding CCIR development and refinement.

Doctrine should redefine CCIR. Current definitions are nearly adequate but they under- emphasize the commander's role in its derivation. Any discussion of CCIR should include a description of how and when it is generated using complexity, systems thinking, and information management principles as a guideline. This description should include: construction of nesting diagrams, sketching nesting diagrams, integration of nesting and the map, mobility analysis, enemy and friendly concept development, mental analysis, determination of decision points and their related CCIR, and development of commander's guidance. *See Diagram 1.*

Field Manual 100-5, *Operations,* should address CCIR by tying it to commander's intent and the concept of the operation. Historic vignettes such as the battle of Ia Drang could be included with proposed CCIR attached to illustrate its potential.

FM 101-5 should emphasize CCIR during the discussion of the MDMP. It should display how and when to do CCIR and how the commander interacts with the staff. FM 101-5 should clarify the type of guidance the commander should give after mission analysis. This reinforces the commander's role in providing direction and vision.[129]

Doctrine should offer graphic CCIR tools that provide intuitive presentation of information that enhances comprehension and usability[130]. Emphasis on the use of cartoons, sketches, and other tools is essential to improving communication of CCIR. Graphic CCIR should be an annex in the OPORD and FM 101-5 should provide models the commander might use. The nesting diagram should be included in FM 101-5 as a standard orders product.

Doctrine should eliminate the laundry list CCIR currently used in Coordinating Instructions[131]. Each set of CCIR should be attached to the decision it triggers. This

links the task, collecting the CCIR, to the purpose, enabling the commander to make a decision, and creates greater comprehension. CCIR should be elevated to the level of an independent maneuver subparagraph following the concept of the operation. This emphasizes its importance and puts it in sequence after the concept where its cognition is most critical and relevant. *See Diagram 2.*

Training should focus on development of junior leader initiative and decision making in order to create small units that are able to use CCIR more effectively. They must be able to read the battlefield and understand the CCIR as it relates to the commander.

CCIR is purposive in that it empowers and relies on emergent control through its collection by subordinate units. This requires that soldiers understand the "big picture" and can make decisions. To develop this trait requires initiative oriented *training.*

Initiative-oriented training cannot be linear if it is to challenge the junior leaders decision making ability. Linear training is task oriented and is evaluated with checklists called training and evaluation outlines (TEO's). This is fine for individual training but is inappropriate for collective training. Initiative oriented training should be realistic. It should replicate key characteristics of the battlefield: uncertainty, purposeful actions, two way communications, and decision making[132].

Traditional task, condition, and standard training is rigid and lacks purpose. The leader should not be given specific conditions. He should be given a task and purpose within the confines of a vague combat situation. He should run into logical but seemingly random events, uncertainty. He should be required to dialogue with a controlling authority to make informed decisions[133]. Evaluation should be framed along

the lines of a cognitive critique that assess time and effectiveness of decisions.[134] Go, no go evaluation should be based on purpose accomplishment and problem solving.

Leader training should focus on decision making versus orders processes. Tactical decision games should be daily events in leader schools[135]. Quick Decision Exercises (QDX) are timed decision drills where the leader is confronted with a mission, a problem, an incomplete situation, and a requirement to provide a solution in a time constrained environment. CCIR could easily be integrated into the QDX to assess the nesting of the chosen solution and the commanders vision. Discreet, task driven, Situational Training Exercises (STX) should be replaced with linked, purpose driven QDX's that integrate fatigue, sleep deprivation, terrain, and weather effect into the decision making system.

Leadership schools should continue to be filled based on merit. They should emphasize problem solving, encourage innovation, and avoid "school solutions".[136] Originality and logical thought should be emphasized. The only real "no go" should be indecision and inaction and linear thinking.[137]

Officer schools should emphasize the development of branches and sequels during practical exercises. Current training emphasizes the base plan and virtually ignores branches and sequels. The CCIR that triggers transition to branches should be tested in simulation and evaluated for utility.

"as the general became more and more bound to his office, and consequently, divorced from his men, he relied for contact not upon the personal factor, but upon the mechanical telegraph and telephone.[138]"

"... it was the amazing unconscious change which rose out of the Franco- Prussian War, and which in a few years obliterated true generalship, dehumanizing and despiritualizing the general, until he was turned into an office soldier, a telephone operator, a dug-out dweller, a mechanical presser of buttons which would detonate battles, as if armies were well tamped explosives or intricate souless machines.[139]"

JFC Fuller

Command Posts (CP) should be simple and functional to prevent the creation of the chateau mentality experienced during World War I[140]. They should not become "bunkers" that isolate leaders from the troops. The bunker mentality of leader separation erodes the potential for shared vision and team learning[141]. A missing commander might gain compliance but will probably lose commitment. A "Palace" CP draws leaders away from the troops and tend to succumb to information pathology.

"Then, as in the last war, he saw them no longer; now and again, perhaps, he heard of them far away, as managing directors sitting in dug outs, in chateaux and in offices."

JFC Fuller[142]

JFC Fuller was discussing the growing tendency of leaders to become enamored with their command and control technology. They stayed at their command posts and lost identity and concern for the soldiers. The results of this during World War I were clear. Commanders should share the soldiers privation.[143] This helps ensure that their decisions are realistic and not based on viewing monitors that display icons rather than units.

The CP functions as a stable information collection environment for the staff. They collect data, process it, posts image building information, and forward execution

information to the commander. Filters should screen incoming data to prevent issue of inappropriate orders and facilitate meaningful guidance[144].

CCIR search engines could be developed to "surf" tactical LAN's to find the execution information the commander has designated. Each "hit" could generate an alarm to gain attention and prevent loss of the data in the confusion of the engagement.[145] Information management can prevent the panic and paralysis induced by information overload by filtering and routing information to decision makers.[146]

The information system should promote bottoms up emergence and adaptation to enable directive control, what the Germans call Auftragstaktik.[147] Management of information through the human filter known as CCIR can prevent overload and inhibit micromanagement which suppresses emergence.

> *"I have said that the staff has no responsibilities; it has none, though it has duties; because it has no powers of decision or command. It can suggest but it has no responsibility for actions resulting; therefore the general alone should and must decide, and, more than this, he must elaborate his own decisions and not merely have them thrust upon him by his staff like a disc upon a gramophone[148]."*
>
> *JFC Fuller*

The search for absolute certainty is folly since complex systems defy exact measurement due to the number of variables that come into play.[149] It might even be seen as a way to escape true command responsibility. The notion that technology will provide perfect awareness is impossible since complex systems defy perfect knowledge. The mere fact that battlefield systems are run by humans ensures that certainty is impossible since computers cannot read minds. The myth that digitization will eliminate uncertainty equates to the notion that tanks would make infantry obsolete or that planes

would make land war obsolete. History shows that whenever a new weapon was created, older weapons and ways of war were declared obsolete by enthusiasts of the new system.[150] This rarely held true. The same will probably hold true of digitization. Focused CCIR keeps the man in the loop, minimizes information overload, builds shared vision, and empowers bottoms up control through the provision of purposive team learning.

CCIR Methodology

- **Nest Enemy and Friendly Forces** - Attain Holistic View
- **Sketch Nesting** - Apply Systems to Terrain in Concept
- **Map Integration** - Translate Concept to Reality
- **Mobility Analysis (AOA / MC)** - Assess mobility options
- **Determine Potential ECOA and COA** - Mental Models
- **Analysis** - Dynamic Mental Simulation
- **Determine DP / CCIR** - Vision building
- **Guidance** - Build Shared Vision

  Guidance that Includes:

  Purpose
  DP / CCIR
  ECOA
  COA
  Critical Events
  Significant Factors
  COA Eval Criteria

Diagram 1

(Decision Point Graphic Symbol)

Decision Points and Supporting CCIR

Communication Tool

(Anticipated Decision)

1

Actions at Rapid Refuel Point enroute to staging area; touch and go or extended FARP

PIR

- Are PRA forces moving into Tugue
- Is 91 IMRB moving into Tugue
- Is enemy arty in range of Tugue
- DC activity
- SPF activity

FFIR

- Status of Oceania Forces in Tugue
- Status of ADVON and RRP security forces
- Corps support to Vigan movement
- Helo fuel status and load

EEFI

- Location of RRP and time of activity
- Arrival of security and consturction of RRP
- Air Corridors into RRP

(Anticipated Critical Information Requirements Linked to the decision)

CCIR OPORD Paragraph

- The commander's projected decisions and why they are important to him, listed by DP portrayed as above, on a map, and on CCIR sketch
- Who the commander believes will be in position to collect the CCIR
- Duration of the time that the CCIR is relevant
- Linkage between CCIR and the decision as the commander sees it

Diagram 2

Paragraph 3. C. Commander's Critical Decisions

I anticipate **5 major decisions** during this operation. The **first decision** is whether to use LZ X-Ray or an alternate LZ. The **second decision** is whether to abort and if so when and why. The **third decision** is when, where, and under what conditions, to employ the battalion reserve. The **fourth decision** is when to defend the LZ, search the Chu Pong, and when to transition. The **fifth decision** is when to withdrawal from Chu Pong.

Although LZ X-Ray is the primary LZ, I want options should X-Ray become unfeasible for the mission. Alternate LZ's are identified. I must know when to divert to them.

Abort criteria are outlined in the CCIR. If certain conditions arise, we will call off the mission to allow the Brigade to assemble a larger force, a larger support package, or gather more lift to facilitate a quicker build up of combat power.

I have provided a small reserve and have asked Brigade to set aside a reserve. These must not be committed prematurely. The CCIR will ensure that we use our reserves when we need them and / or ask for the Brigade reserve when it is needed.

Once we are committed to LZ X-Ray, I must determine how long to defend the LZ, when to begin our search. We must be able to secure the LZ for follow on forces but I also want to start the search as soon as possible. I'll need to know, early on, if an extended defense is required.

Lastly, I need to know when to withdrawal from Chu Pong. We are not going there to stay. Either we successfully complete our mission or we determine that the mission is not feasible as it is. I want to execute and get out as quickly as possible. Reference CCIR ANNEX XX

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By the Monday morning, the fire had engulfed 15,000 acres and heavy winds had pushed the fire to the north side of town. Some 14,000 buildings were ablaze and 75,000 of the city's population of 350,000 fled their homes. Looters took to the streets. General Sheridan and the legendary detective Allan Pinkerton were called in restore order.

The fire was doused by a shower by Tuesday morning. Over 250 people were killed with 250 more missing. Three and a half square miles of city was destroyed. Nearly 17, 450 buildings burned down at an estimated cost of 200 million dollars. What allowed this to happen?

A three month draught was in effect at the time of the fire. Annual rainfall was only up to one quarter of normal. Forest fires were raging in Michigan and Wisconsin. The fire department consisted of only 200 firemen and 17 fire engines. They had answered 40 alarms the week before the great fire and had fought a 15 hour blaze the day. One third of the city's hose was defective due to recent heavy use. Two thirds of the city's 65,000 buildings were wood construction and they were connected by 650 miles of raised pine wood walkways.

These initial conditions should have forecasted the possibility of a catastrophe. A systems thinker figure that a four month draught, an escalation of fire alarms, the city's wood construction, and regional forest fires would indicate a time to adapt. He would hire more firemen or recruit volunteer firemen. He would test, update, validate, and rehearse, the alarm notification and reaction system. He would consider the fact that Chicago is the windy city and winds could spread fire. He would intensify equipment maintenance, repair, and replacement.

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